Where to locate new energy infrastructure? A natural capital approach

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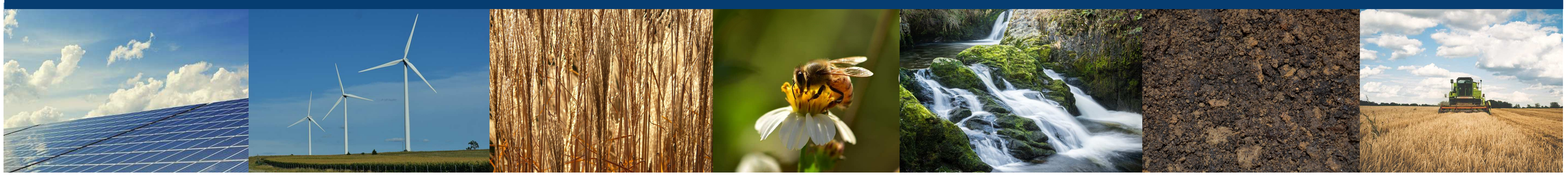


BACKGROUND

- To **achieve net zero emissions** by 2050, the Committee on Climate Change has advised the UK should:
  1) Quadruple low-carbon electricity supply
  2) Deploy bioenergy with carbon capture & storage
- **Where** is this energy infrastructure going to be located?
- **How** will the environment be affected by the land use change associated with our transition to a low carbon energy future?

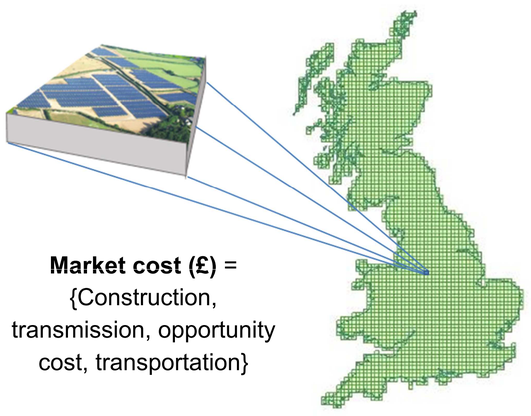
AIMS

- To develop a **national scale cost minimisation model** to explore the spatial implications of multiple renewable energy technologies.
- To include the **impact on the environment from land use change** in the spatial optimisation model.
- To improve our understanding of the **trade-offs between energy, agriculture and the environment** as the UK transitions to a low carbon energy future.

MODEL

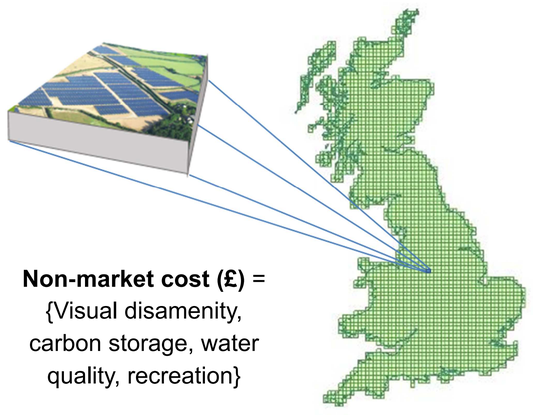
This model developed for the UK Energy Research Centre's **Addressing Valuation of Energy and Nature Together (ADVENT) project** explores the **optimal locations** for **solar, wind** & **bioenergy** generation to **benefit society the most**.

1. Determine market cost of locating energy in 1km^2 cells



Market cost (£) = {Construction, transmission, opportunity cost, transportation}

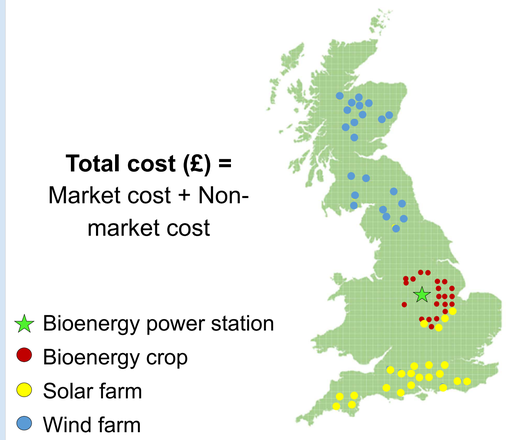
2. Determine non-market cost of locating energy in 1km^2 cells



Non-market cost (£) = {Visual disamenity, carbon storage, water quality, recreation}

3. Optimise the locations of wind farms, solar farms & bioenergy

Total cost (£) = Market cost + Non-market cost

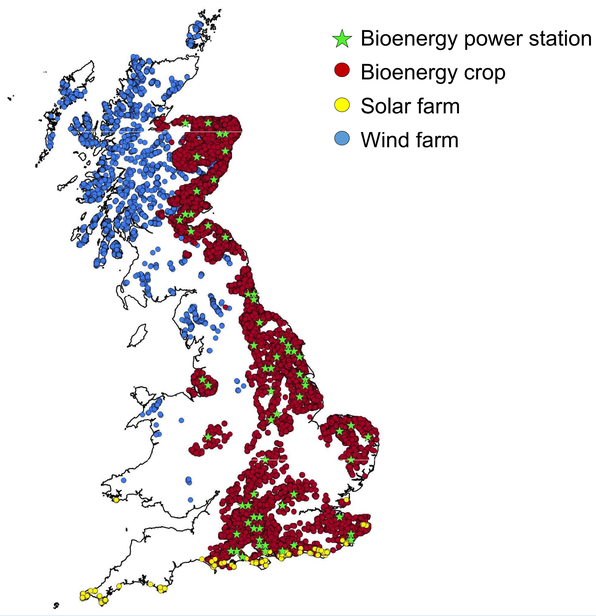


Non-market costs are calculated for goods & services not traded in markets (i.e. clean air), using economic valuation methods.

PRELIMINARY FINDINGS

The model determines the **best locations** for solar farms, wind farms, bioenergy power stations and bioenergy crops for a given potential energy pathway. The **financial scenario** minimises market costs whereas the **social welfare scenario** minimises market & non-market costs**.**

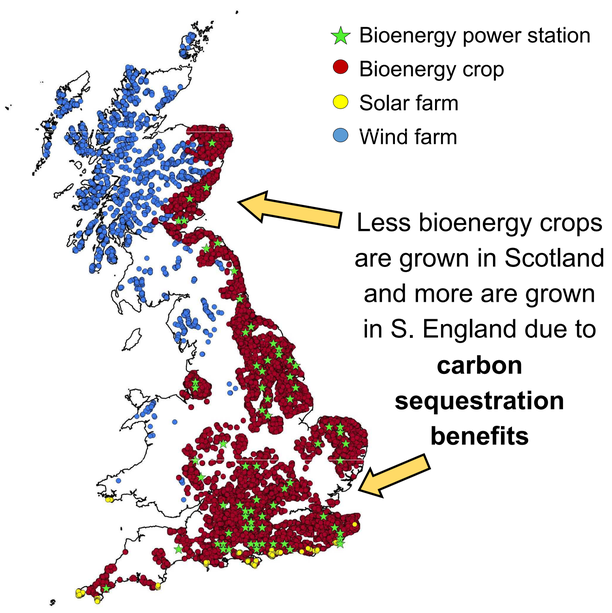
Financial scenario



….locations are chosen to minimise **construction, transmission and opportunity costs**

Spatial footprint	2.01M ha
Annualised cost	£3.41 billion

Social welfare scenario



….locations are chosen considering the value of **nature** alongside financial costs

Spatial footprint	2.03M ha
Annualised cost	£3.36 billion

CONCLUSIONS

- Increased reliance on **home-grown bioenergy crops** could result in over 2,000,000 ha of **land use change**.
- Modelling the implications of energy infrastructure on the environment can be used to **inform the government's new environmental land management scheme which will reward land managers who deliver public benefits** (i.e. water quality, carbon storage, recreation).

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